ILLINOIS POLLUTION CONTROL BOARD
August 7, 1981

IN THE MATTER OF:	)	
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AMENDMENTS TO CHAPTER 2, AIR POLLUTION CONTROL RULES AND REGULATIONS, RULE 203(g).	)	R79-11

PROPOSED OPINION OF THE BOARD (by I. Goodman):

This Opinion supports the Order entered herein on July 23, 1981.

On February 15, 1980, Caterpillar Tractor Co. (Caterpillar) filed a substitute proposal to add a subsection to Rule 203(g) of Chapter 2: Air Pollution Control Rules and Regulations to limit particulate matter (TSP) emissions from coal-fired industrial boilers equipped with flue gas desulfurization systems (scrubbers) to 0.25 pounds of TSP per million Btu of actual heat input. Although the original proposal submitted on September 5, 1979 limited the rule to spreader stoker boilers, Caterpillar's February 15, 1980 amended proposal proposed the rule's applicability to all industrial boilers using coal to provide energy for heating, ventilation, manufacturing and related operations.

Technological hearings were held on January 16, 1980 in Peoria and February 15, 1980 in Chicago; economic hearings were held on January 13, 1981 in Chicago and January 19, 1981 in Peoria. At hearings, testimony from Caterpillar and from both industrial and environmental organizations was heard.

The Board has received public comments from a business organization, a governmental department, an environmental organization, and a legislator. A newspaper article and a witness' post-hearing responses to questions were also included in the Board's public comment file. A synopsis of the written comments follows.

The Illinois Department of Commerce and Community Affairs supported the petition, citing Caterpillar's history of commitment to using available technology, the need to encourage industries to use Illinois' high sulfur-content coal, and the need to adopt environmental standards which are similar to those of adjacent states in order to facilitate the Department's efforts to retain

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The Board acknowledges the assistance of Ms. Terry E. Cox in the drafting of this Opinion and in acting as hearing officer herein.

existing Illinois industries. United States Representative Tom Railsback stated general support for the use of scrubbers which enable the use of Illinois coal. The Illinois Coal Association (ICA) stated that the greatest impediment to the increased use of Illinois coal is the difficulty in reducing sulfur dioxide emissions without the use of scrubbers, which it maintained are not yet fully developed control technologies. The ICA further stated that retrofitting spreader stoker boilers with scrubbers generates particulate matter, which side effect should be weighed against the reduced sulfur dioxide emissions gained with the use of scrubbers. Finally, ICA stated that Caterpillar's projected use by 1985 of 450,000 tons per year of Illinois coal is not of insignificant consequence when presently some 17,000,000 tons of low sulfur, non-Illinois coal are imported into the state, and that the use of oil or gas would be an inefficient use of energy resources. Deere & Company reiterated that the effect of the proposal would be a reduction of Illinois Industry's dependence on foreign oil and thereby a reduction of inflation.

Citizens For a Better Environment (CBE) stated that the proposal should be restricted to boilers owned by Caterpillar which are presently equipped with scrubbers, and should not be adopted as a statewide regulation. CBE wrote that at the hearing of January 13, 1981 the impact of the proposal upon ambient air quality was not adequately assessed in that one affected source had already installed a dry scrubber and other sources could be ordered under various laws to convert to coal as a fuel for combustion. Further, CBE cites the fact that the Illinois Institute of Natural Resource's economic impact study considered impact only with respect to four of Caterpillar's five affected Illinois plants.

Caterpillar's petition states that of six Illinois industrial sources constructing or using scrubbers on spreader stoker boilers, five are Caterpillar's plants. Pending completed scrubber construction these five plants had controlled the particulate with multiclone dry particulate dust (flyash) systems. Caterpillar intends to apply to the United States Environmental Protection Agency (USEPA) for a new source, innovative system of continuous particulate matter reduction determination pursuant to §111(j) of the Clean Air Act (CAA), 42 U.S.C. §7401, et seq. (Petition, p.1, n 1.)

Caterpillar filed this proposal in conjunction with the filing of four variance petitions (PCB 79-188, -189, -190, and -191; see consolidated Order of November 29, 1979, modified January 24, 1980, and consolidated Opinion of November 29, 1979). These variances from the particulates emission limitation of 0.10 lbs./million Btu[1] imposed, pending this regulatory proceeding, limitations of 0.23 lbs./million Btu (East Peoria boilers #21

[1]Contained in the State Implementation Plan (SIP) (see §110(a) of the CAA) as Rules 203(g)(1)(B) and (C). See, also, Illinois State Chamber of Commerce, et al. v. Illinois Pollution Control

and #22), 0.27 lbs./million Btu (Mossville boiler #5), 0.28 lbs./million Btu (Joliet boiler #3), and 0.25 lbs./million Btu for thirteen other boilers at those four plants. In those petitions, Caterpillar alleged that its regenerative double alkali scrubbers were an incompletely developed, innovative technology; the Agency's variance recommendations concurred that these scrubbers had been thought to be the best technology available when considered for installation by Caterpillar during the early 1970's. Caterpillar's regulatory petition states that during hearings in R71-23, which first adopted Rule 203(g), Zurn Industries, Inc., a manufacturer of the double alkali scrubbers, testified that the scrubbers would reduce particulate emissions by 98%, but that Caterpillar's data show only a 52-71% effectiveness. Caterpillar states that its problems are similar to those of General Motors Corporation. (Petition, pp.14-15.)

Some of the excess particulate matter emissions are attributable to the carryover of sulfuric acid mist and scrubber liquid salts from the scrubbers. Carryover contributions range from 18% (1977 Joliet stack tests) to 50% (1979 Mossville stack tests). USEPA has recognized this, in relation to its particulates Test Method 5, as a problem stemming from the combustion of high sulfur coal.[2] Approximately half of the particulate emitted from the Joliet and Morton boilers are greater than one micron in size; Caterpillar has sought to reduce the amount of fine particulates (submicron) emitted, and has identified some of its problems therewith. For example, when stored coal is exposed to natural elements, the resulting increased moisture content causes variability in heat output during combustion, and a boiler design criterion of 30% excess air can seldom be attained due to both the moisture content and the lower ash fusion temperature. Reinjection into the boilers of flyash captured by the multiclones may cause increased particulate emissions, and spreader stoker boiler manufacturers will supply guarantees only as to combustion efficiency and not stack emissions. (Petition, pp.16-20).

Caterpillar alleges that its scrubbers are the best particulate matter control technology available, but that no technology exists for satisfactory simultaneous control of both sulfur dioxide and

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Board and consolidated cases, 67 Ill.App.3d 389, 384 N.E.2d 922 (1st Dist.1978), and People v. Commonwealth Edison Company and related case, 490 F.Supp. 1145 (N.D.Ill.,1980). The limitation is also the one applicable as the new source performance standard for industrial boilers. Section 9.1(b) of the Illinois Environmental Protection Act (Act); 40 C.F.R. §60.42.

[2]Public comment of Citizens For A Better Environment, submitted during the First Notice period, states that USEPA is experimenting with a Test Method 5B at a General Motors plant and is considering similar experimentation at one of Caterpillar's plants.

particulates when the combustion fuel is Illinois coal. Therefore, Caterpillar contends that it would be economically unreasonable for the Board to require either additional controls or the installation of replacement technology. The proposal, besides promoting the combustion of Illinois coal, and effectuating an economic boost therefrom, is alleged not to adversely impact ambient air quality, although it is clear that more than twice the amount of particulate allowed under the SIP and the new source performance standards would be emitted into the atmosphere.

At hearings, evidence was received in support of Caterpillar's contentions. When the CAA and the Act were enacted in the beginning of the 1970's, Caterpillar experienced a variety of problems with the combustion fuels of gas, oil, and low sulfur coal (R.16-21). Although natural gas had been touted as being in reasonable supply, later federal regulations gave supply priority to the public rather than to industry. Caterpillar concluded that natural gas was not a dependable fuel. Oil similarly was undependable over the long term, primarily because producers had little desulfurization capacity and because of ongoing federal regulatory activity in the face of a continued unfavorable domestic-to-imported ratio. The use of electricity was considered to be prohibited by cost.

As to low sulfur coal, it was in short supply in the early 1970's. (Caterpillar defines "low sulfur" coal as coal for which no scrubbers are necessary to meet sulfur dioxide emission limitations.) Caterpillar's decision against low sulfur coal centered upon the dependability of timely deliveries; given problems relating to rail transportation (labor, car availability, loading competition, accidents), a steady supply was not foreseen. In contrast, Illinois coal could be transported by highway and barge in addition to rail. Caterpillar for these reasons decided to use Illinois coal and to invest in the necessary scrubbers. However, after this decision was made the supply of low sulfur coal improved. Caterpillar committed one of its plants to the use of this coal (R.19-20).

Several legal considerations involved in use of oil or natural gas as combustion fuels exist. The Powerplant and Industrial Fuel Use Act of 1978, Pub.L. 95-620, November 9, 1978, 92 Stat. 3289, which supersedes the Energy Supply and Environmental Consideration Act of 1974, prohibits the use of oil or gas in boilers upon which construction commenced after November 9, 1978 unless an exemption is obtained. In addition, the United States Department of Energy can require conversion to coal as the combustion fuel if boilers have coal-burning capacity. All of Caterpillar's boilers have the capacity to burn coal. Finally, the Natural Gas Policy Act of 1978, Pub.L. 95-621, November 9, 1978, 92 Stat. 3350, had imposed mandatory incremental pricing regimes on domestic natural gas supplies.

New source performance standards for industrial boilers (see §111 of the CAA and 40 C.F.R., Part 60) are expected to be proposed by the USEPA in revised form in November of 1981. In the alternative,

regulations may be promulgated which require utilizing adequately demonstrated operational and other standards reflecting the best technological system of continuous emission reduction which takes reduction costs as well as energy requirements into account (§111(h) of the CAA; see also §111(a)(7) and (8) and §111(b)(5) and (6)). Section 111(a) of the CAA would apparently give emission credit for pre-combustion coal treatment (coal washing, etc.), whereas such credit is uncertain under §111(h). Most of Caterpillar's boilers would be "new" sources for purposes of these provisions of the CAA. Nothing in this Order negates applicability of §111 of the CAA.

Soon after the particulate matter emission limitations were first promulgated by the Board, Caterpillar determined that one way to meet both the sulfur dioxide and the particulates emission limitations would be to desulfurize the coal before applying control equipment,[3] which procedure could address the problem of small-sized particles. Such procedures would include coal beneficiation (R.21-3). The record contains no evidence as to the technological feasibility or economic reasonableness of these procedures. On October 27, 1978 Caterpillar met with representatives of the Agency and of the USEPA to discuss improvements in scrubber technology. The meeting was unsatisfactory. Caterpillar's experience with venturi scrubbing has been unsuccessful, regardless of the level of pressure drop during operation (R.76-8).

Caterpillar, then, seeks a technology-based particulate matter emission limitation; the technology would be regenerative double alkali scrubbers equipped with flyash arrestors (e.g., multiclone collectors) of good engineering practice design (R.25). Some measures to reduce or minimize the coal's contribution to particulate emissions have been taken (coal analyses upon delivery) but some have not (storage in silos to prevent absorption of moisture) (R.136-9).

Further support of an emission limitation greater than 0.10 lbs./million Btu was presented in a July, 1979 USEPA report of pebble lime (CaO) or ground limestone ($CaCO_3$) scrubbers which remove both sulfur dioxide and particulates without additional particulate control equipment. The report was based on 2-4% (medium-high) sulfur content coal and achieved emission rates only as low as 0.15 lbs./million Btu, with typical rates ranging from 0.20 to 0.30 lbs./million Btu. Particulate removal averaged 93-4%. (See Ex.3.) Caterpillar believes that its proposed 0.25-lb. limitation for regenerative double alkali scrubbers is consistent with this study (R.50-1); however, the two control systems are not identical.

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[3] USEPA is currently determining whether to regulate emissions of particulates in terms of size; such regulations would likely change the applicable particulate matter emission rates for both new and existing sources. See also 45 Fed.Reg. 84098-9 regarding Agency SIP submittals.

Caterpillar does not believe that ceasing the reinjection of flyash, which can lower particulate emissions, would justify the increased energy expenditures occasioned thereby. To improve the performance of its scrubbers, Caterpillar has improved the operation of the demisters, modified its chemicals handling procedures, and replaced bypass dampers to minimize leakage. To date, $27 million has been expended by Caterpillar to meet both sulfur dioxide and particulate emission limitations (R.39-1,117,126-8). It alleges that its present system constitutes "best available [particulate matter] control technology" (see §169(3) of the CAA) and that it would be technologically infeasible and economically unreasonable to require, in order to meet both sulfur dioxide and particulates emission limitations, either additional controls or, assuming the availability of a new generation of scrubbers or other technology, replacement of its existing controls. Caterpillar alleges that the "ultimate solution" to compliance with both sulfur dioxide and particulate emission limitations when using high sulfur coal is the desulfurization of that coal in order to make the use of scrubbers unnecessary and to enable the use of particulate matter controls without "scrubber interference". Desulfurizing the coal would address the problem, and not the result (R.41-2,47). Indeed, Caterpillar is unsure of the proportions of its particulate emissions constituting flyash, sulfuric acid mist, or both. Although intermittent control systems and fluidized bed processes could be appropriate control technologies (R.168), these are allegedly insufficiently developed to date. Further development of controls may be delayed if designers are made to consider intermittent rather than continuous control methodologies.

Caterpillar's boilers would not be the only sources subject to its proposal. At least one other source, the Pfizer plant in East St. Louis, presently uses scrubbers (R.52). Other possible affected sources exist (R.151-6)[4] but the record does not reveal their identity or location. Caterpillar seeks to have the proposal apply statewide to all industrial boiler sources. Particulate matter removal capability, however, may be unrelated to other physical or chemical plant and equipment configurations (R.52-8).

Caterpillar hired ETA Engineering, Inc. (ETA) to model the expected air quality impacts of increasing the particulate matter emission limitation from 0.10 to 0.25 lbs./million Btu. Its report was made Exhibit 6 to this proceeding. (The Illinois Institute of Natural Resource's economic impact study, see post, which also evaluated air quality impacts, considered four of

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[4]The Agency pointed out that Caterpillar's proposal may force Pfizer's plant to decrease allowable emissions by 7.7 pounds per hour from its three boilers which vent to one stack (R.159-1). Although the Illinois Manufacturers' Association is conducting a survey to ascertain potentially affected sources (R.155-6), the record does not contain the results of such study. However, any industrial source having scrubbers comes within the rule.

Caterpillar's plants, whereas ETA's considered the Morton plant as well.) ETA's study used as input to USEPA's Climatological Dispersion Model (CDM) projected 1980 Illinois coal usage data and current stack test data. One hundred sixty-eight equidistant receptors points were used; annual concentrations were based on "expected 1980 annual emission rates" and the receptor area concentrations were calculated by ratioing the concentrations in proportion to the change in emissions were a 0.25-lb. limitation to be allowed at each plant (R.91-2). Incremental impact on air quality was shown by computing the differences between concentration levels monitored at the receptors; maximum annual concentrations were used to estimate by the Larsen procedure[5] maximum 24-hour concentrations.

Results of ETA's modeling showed maximum annual concentrations of the five facilities, in micrograms per cubic meter (ug/m^3), as: Joliet, 3.0; Mossville, 2.7; East Peoria, 1.1; Mapleton and Morton, 0.6. These concentrations range from 0.80% (Mapleton) to 4.0% (Joliet) of the primary annual particulate matter national ambient air quality standard (NAAQS), and from 0.8% (Mapleton) to 5.5% (Joliet) of the 24-hour NAAQS. Annual incremental concentrations ranged from 0.2 ug/m^3 (Morton) to 2.3 ug/m^3 (Joliet); the "level of significance," as defined by USEPA for PSD purposes, is 1 ug/m^3. Twenty-four-hour incremental concentrations ranged from 0.7 ug/m^3 (Morton) to 11.2 ug/m^3 (Joliet); the "level of significance" here is 5 ug/m^3. Although the Mossville plant as well as the Joliet plant violate both "levels of significance," the Mossville plant's impacts were measured within a 0.17-square-mile area around the facility and were completely within the plant property. As to the Joliet plant, 44% of the readings were within plant property and the remainder were upon nonresidential land within a 0.22-square-mile area around the plant. These figures are likely to be inaccurate given that the Hi-Volume sampler reference method can produce deviations from true statistical values of $\pm$ 50% depending on air flow rate and whether particulate has clogged the filter (R.96-100). No information regarding particle size was presented, although Caterpillar has such information for at least the Joliet and Morton facilities. (Pet., p.17).

Caterpillar cites that reductions in background concentrations, particularly in Peoria and Joliet, will soon be achieved by reductions of industrial and nontraditional source emissions of fugitive dust mandated by recently promulgated R78-11. The CDM, however, did not account for the effects of terrain. Caterpillar further notes that none of the areas where concentrations over 1.0 ug/m^3

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[5]The Larsen procedure uses as one variable the data's standard geometrical deviation; this input is allegedly higher for the Joliet portion of the modeling than the correlative input used by the Agency in its study of Peoria area air quality. The result might be ETA's overestimation of both high and low maximum concentrations for the Joliet area (R.106-7).

(24-hour) were recorded are accessible to the public (R.134-5). The Board notes that Edwards power plant is 7.4 kilometers, and Powerton is 5.4 kilometers, away from the Mapleton plant, and that Wallace is 1.1 kilometers away from the East Peoria plant. Caterpillar suggests that impact on air quality would be negligible because the variation in monitored incremental concentrations would likely be greater than the entire contribution from the plant; in other words, the plant's contributions are within the error range of the monitoring technique itself (R.113-4).

Caterpillar has spent over $27 million in capital costs in an effort to comply with both sulfur dioxide and particulates emission limitations. Caterpillar estimates that in order to comply with a 0.10-lb. particulate emission limitation it would have to undergo extensive modifications of its plants to accommodate the installation of particulates-controlling baghouses; however, there may be insufficient space both within and outside of the plants for the installation of baghouses. Another modification would be the replacement of the stack gas systems and, possibly, the stacks. These modifications would consequently necessitate a change in electrical service to the newer and larger induced draft fan systems. Finally, it would be important not to interrupt the boilers' steam service for manufacturing operations. Such modifications could be made at a capital expenditure of $50-60 million over a three- to five-year period (R.120-1, 128-0).

The economic impact study of the Illinois Institute of Natural Resources, Doc. No. 80/24, November, 1980, "The Economic Impact of [R79-11] to allow a Relaxation of [Rule 203(g)]" (EIS), used these Caterpillar cost estimates in balancing the "benefits" of the proposal. ("Benefits" in economic impact studies are typically defined as foregone source expenditures when the environmental proposal is to loosen a standard because there can be no health benefits to increased pollution.) The study mentioned that besides Pfizer, one other coal-fired industrial boiler source may exist and stated that the degree of economic impact of the regulation depends on the number and size of affected sources. (EIS, pp.2-1 to 2-4.)

The EIS described the benefits of this regulation as eliminated air pollution control costs associated with meeting the limitations contained in the SIP. (EIS, pp.1-4.) Four accounting scenarios were projected to describe secondary costs (described as "loss of benefits," pp.1-4) and secondary benefits (described as loss of costs to Caterpillar consumers and suppliers). These were: (1) all of Caterpillar's costs were passed on to its consumers, sales figures remaining constant; (2) costs were passed on but Caterpillar expensed its capital and operating costs; (3) costs were not passed on and Caterpillar expensed over two years' time; and (4) cost amounts were allocated to production rather than air pollution controls. (EIS, pp.5-1 to 5-7.) The study's conclusion, in comparing costs with benefits, is that from inauguration of the $50-60-million compliance plan, given a two-year construction

period, the state economy obtains a short-term economic stimulus, and that this stimulus will be greater if all equipment is purchased from Illinois manufacturers, e.g., $91 million instead of $57 million (EIS, pp.6-2.) When total health and other social costs from the increased pollution, not to be greater than $400,000 (depending on the damage coefficients used), are considered, the study's conclusion is that the cost to Caterpillar of disallowing its proposal is far greater than the cost to the public of allowing its proposal.

The Board does not limit its findings to Caterpillar's four plants and will apply the regulation to other sources and installations. The Board has adopted an Order with reference to all sources existing as of the date of the final order herein which presently have installed scrubbers of any kind. However, the Board notes that, pursuant to §9.1(b) of the Act, presently existing industrial boilers equipped with scrubbers may become subject to the USEPA's new source performance standards when they are promulgated. See also Part IX of Chapter 2: Air Pollution Control Rules and Regulations. Although conversion to coal from another type of fuel alone may not convert an existing coal-designed source to a modified source for purposes of the CAA (40 C.F.R. §60.14), other operational modifications can lead to this consequence.

A particulate matter emission limitation on industrial boilers of 0.25 lbs./million Btu is found to be technologically feasible using either wet or dry flue gas desulfurization systems (scrubbers). Caterpillar as an example has met close to this limitation to date, using high sulfur-content coal, and with further sensible preventive practices (for example, dry storage, pretreatment, and proper equipment operation) all affected sources will be able to consistently meet both this limitation and the SIP's sulfur dioxide limitation.

The Board also finds that allowing this higher emission limitation is economically reasonable. Given Caterpillar's past scrubber expenditures, allocated both for particulate matter and sulfur dioxide control, and given the scrubbers' successful removal of sulfur dioxide, the Board finds that requiring compliance with anything other than a technology-based emission limitation for simultaneous compliance with particulate matter and sulfur dioxide limitations would be economically unreasonable. Caterpillar has retrofitted multiclones upon the scrubber operation; to require redesign based upon the present scrubber equipment would involve extensive modifications of plant, equipment, and operating procedures.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion was adopted on the 7th day of August, 1981 by a vote of 4-0.

Christan L. Moffett, Clerk
Illinos Pollution Control Board